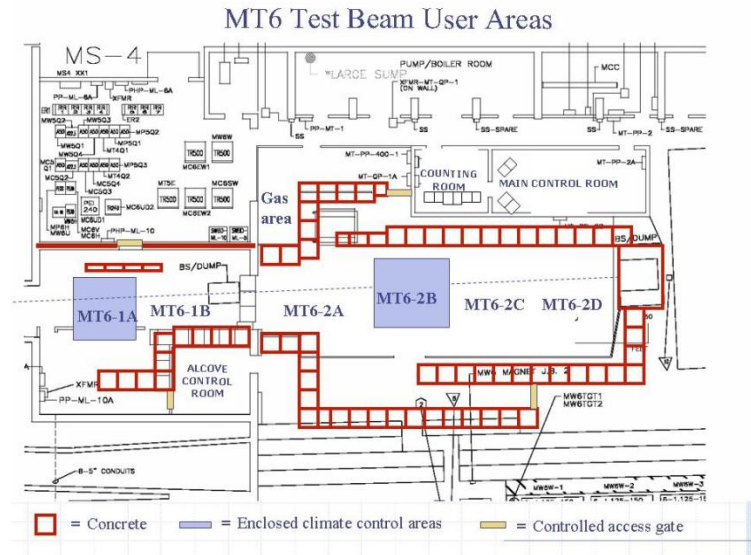


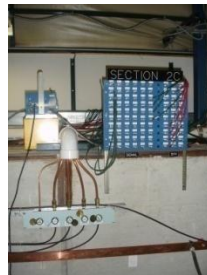
Using MCenter as a Test Beam Facility

Erik Ramberg
9 October, 2009

The Current MTest Facility



Spacious control room



Signal and HV cables



Gas delivery to 6 locations



4 station MWPC spectrometer

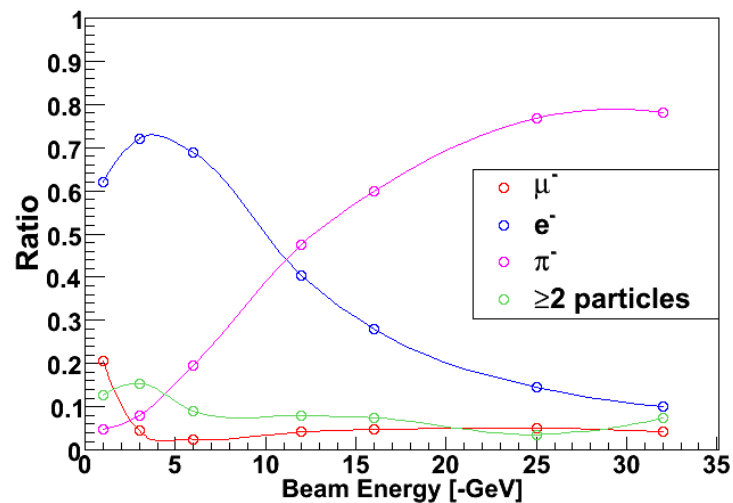


Two motion tables

Beam Characteristics

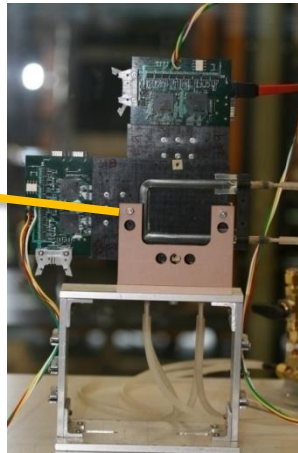
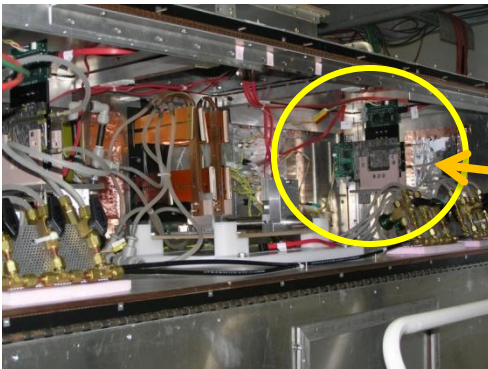
Measured rates for 1E11 at MW1SEM

Beam Energy (GeV)	Rate at Entrance to Facility (per spill)	Rate at Exit of Facility (per spill)	%Pions, Muons**	% Electrons**
16	132,000	95,000	87%	13%
8	89,000	65,000	55%	45%
4	56,000	31,000	31%	67%
2	68,000	28,000	<30%	>70%
1	69,000	21,000	<30%	>70%



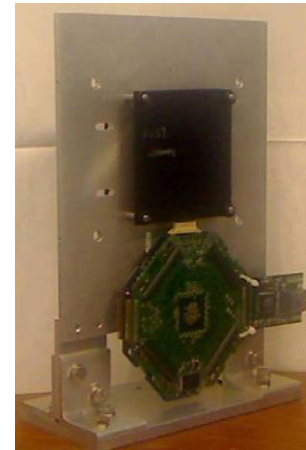
2 New Pixel Tracker telescopes in MTest

BTeV/PHENIX SENSOR TELESCOPE:



- Sensors are spares from BTeV project, read out with FPIX chip
- Pixel size is $50 \times 400 \mu\text{m}^2$
- Total active area per X-Y station is $6 \times 6 \text{ cm}^2$
- Two stations currently, which should give 6 micron resolution

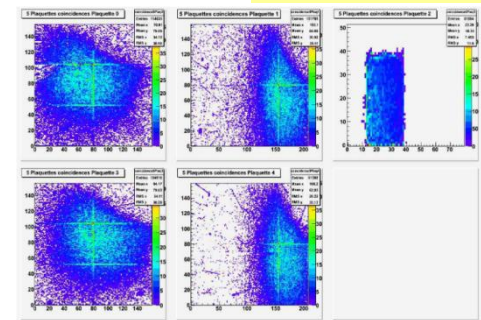
CMS SENSOR TELESCOPE:



Sensors are CMS B-grade, but functional at low intensity.

Overlap area is $2 \text{ cm} \times 2 \text{ cm}$

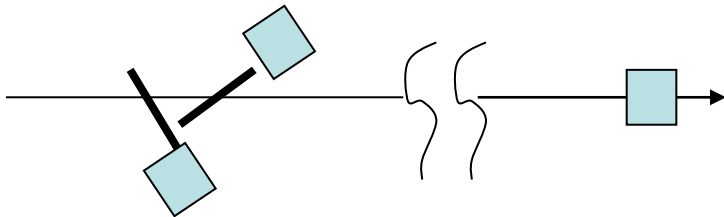
4 stations of $100 \times 150 \mu\text{m}^2$ pixels gives $4 \mu\text{m}$ resolution



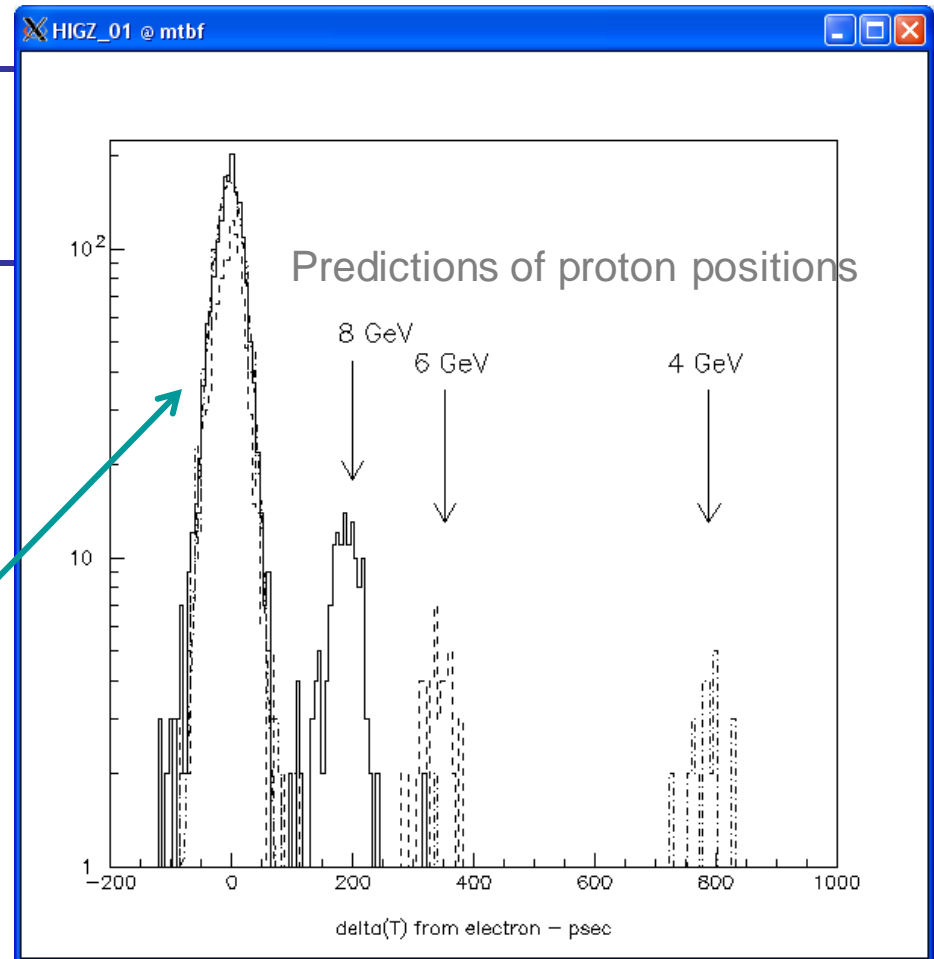
Extreme Time-of-Flight System



Start = Double-Q-bar
Stop = Photek 240
Start-stop dist. = 8.7 m

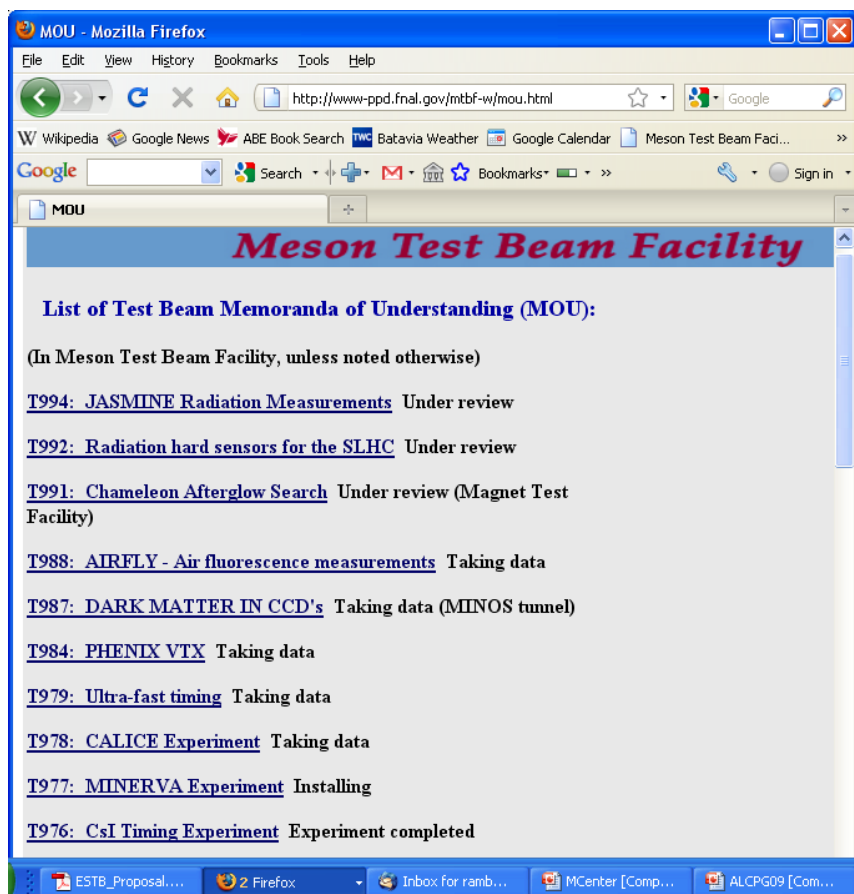


24 psec resolution
positron peak, using
average of A & B times



We can measure momentum of a high-energy proton using this system.

A World-Class Program

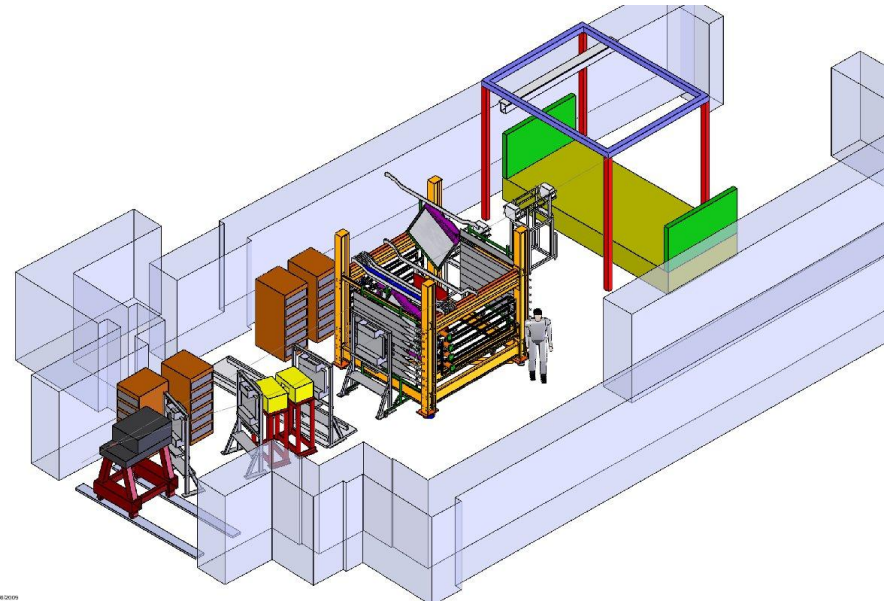


Affiliations of Test Beam Users, According to their MOU

<u>Year</u>	<u>Experiments</u>	<u>Institutions</u>	<u>People</u>	<u>Countries</u>
2009	7	49	147	14
2008	5	42	112	13
2007	10	28	102	8
2006	5	18	65	6

Is Another Test Beam Necessary? Yes

- Although MTest is a very good facility, there are some problems:
 - Currently, the Meson Test Beam Facility can support 1 or 2 large scale detector tests – CALICE and MINERVA now fill up the available space.
 - Conflict in beam scheduling has already occurred this year due to the presence of only a single test beamline.
 - There is no flexibility for envisioning a future program that might be dedicated to specialized test beam
- Solve this by creating a second test beam facility



3D modeling of MTest showing the Minerva tertiary beam setup and detector , along with CALICE

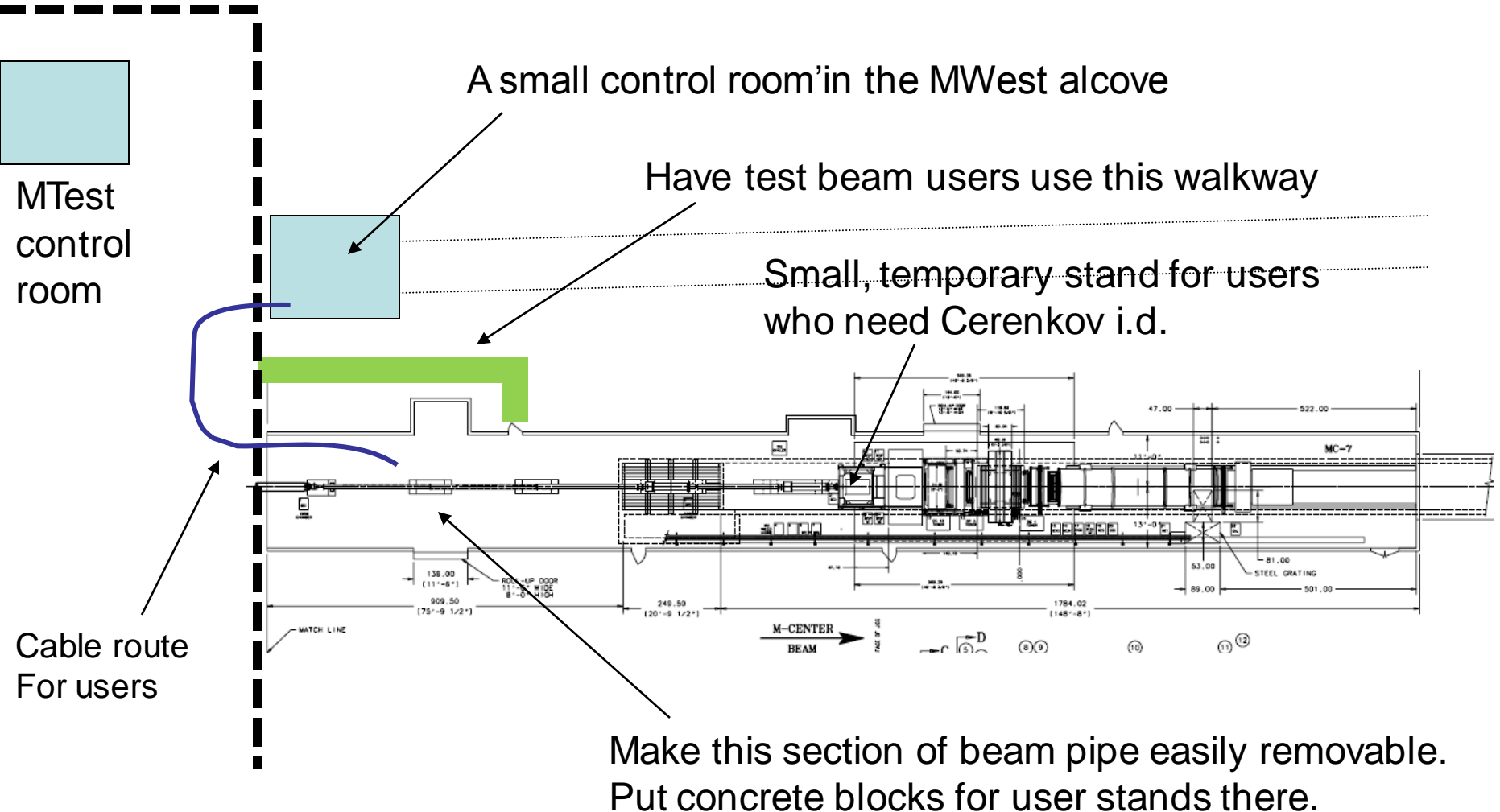
The Philosophy for Test Beam in MCenter

- We should get the maximum use of the MCenter beam as possible and keep the beamline and experimental area from degrading.
- It is natural to support a test beam facility there. The beamlines are very similar, and there is room for tests.
- A user area in MCenter can be created such that there is minimal impact on the spectrometer and control room for MIPP.
- Preparations for supporting test beam users will kick into gear the upgrades of the MCenter beamline and MIPP spectrometer
- In the future, after a MIPP physics run, we can contemplate how to integrate parts of the spectrometer into large scale, world-class test beam efforts, as envisaged by ILC.

The Pitch to DOE

- Young-Kee proposed to Howard Nicholson that Fermilab could use MCenter as an adjunct test beam facility.
- We received \$190K for this purpose
- Breakdown of use of this money in the proposal:
 - Refurbishment of beamline: \$50K
 - Repairing JGG and tracking: \$100K
 - Overhead: \$20K
 - Contingency: \$20K
- Note that all of this money is very MIPP-friendly, with none specifically targeted to a new test beam user facility
- We should decide now to add this capability, especially given the interest for such by the DOE.

A Small, but Elegant, Test Beam Area in MCenter



Advantages for Test Beam Users

- It centralizes test beam operations in the Meson Detector Building and keeps test beam users in their own control room area rather than the MIPP portakamps.
- It emphasizes the upstream area, where there is little impact on the MIPP spectrometer. No one would have to work around MIPP detectors.
- Cable runs are much shorter than detectors placed in the downstream area.
- Commissioning the MIPP experiment can take place at the same time as test beam use in this scheme.

Advantages for MIPP

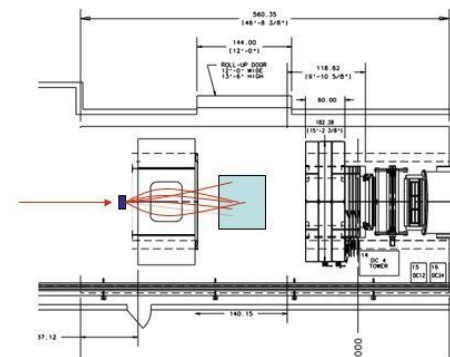
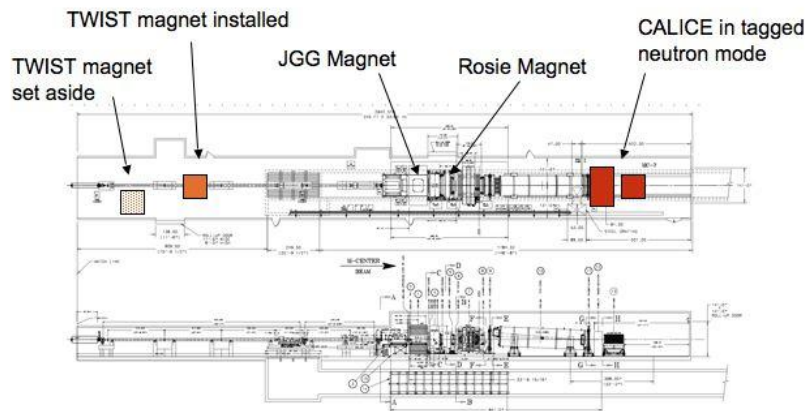
- Following this plan will bring beam to MCenter almost immediately and will guarantee operational beam whenever MIPP can take advantage of it.
- Students will be able to start re-commissioning MIPP detectors as part of a detector-centric effort, even before MIPP-2 is approved.
- Bragging about the MCenter facility will attract interest in what can be done with the MIPP experiment and its upgraded beamline.
- It would have a distinctive difference from MTest due to the presence of the MIPP spectrometer. If MIPP can show reliable tagged neutron capabilities, then there would be an impetus to keep that spectrometer alive for quite an extended period.

Melding MTest and MCenter

- I propose that test beam operations in MTest/MCenter be undertaken with the view that MIPP will have another run.
- Scheduling for placement in MCenter will be undertaken with a long view:
 - If a proposed experiment is of short duration, as in a week or two (like most test beam experiments), then there should be no problem accommodating this.
 - If there is a proposal to use MCenter for several months or more, then this would have to be undertaken with MIPP status taken into account.
- The only significant change to the MIPP apparatus in this plan is the presence or absence of a beam pipe, which is completely reversible in about 4 hours.
- If MCenter is to be used for test beam activities, then the process by which beam is scheduled there must be firmly established.

A Longer View of Test Beam in MCenter

- Allow the MIPP experiment to perform measurements with updated tracking and a repaired JGG magnet.
- Use the MIPP apparatus to create a tagged neutron facility.
- Import a large bore solenoid for TPC tests (the TWIST magnet from TRIUMF is a possibility) ILC users desperately want this!
- Use the MCenter spectrometer to simulate jet physics for advanced calorimetry. There is a big argument going on now about advanced calorimetry. Fermilab could solve that argument.



Creating a 'jet' in the Jolly Green Giant

Toy schematic of future programs

Summary

- Fermilab hosts a great test beam program, that attracts the world-wide detector development community.
- There are enough large scale tests going on, such that the use of the MTest facility is compromised.
- We have been funded by the DOE to create an adjunct test beam facility in MCenter. We should begin this work.
- It is easy to arrange things so that both MIPP and an MCenter test program can coexist
- Advancing this program will dramatically help MIPP to enact a future run.